ROLE OF SPATIAL CORRELATION IN OPTIMIZATION UNDER UNCERTAINTY

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By combining trust-region algorithms with response surface models, it is possible to develop an efficient framework for optimization under uncertainty [1]. To develop algorithms, concepts from both optimization theory and spatial statistics are needed. It is anticipated that such algorithms will be fundamentally different from stochastic optimization, the existing method for optimization under uncertainty. The first author has been working with Eldred, Giunta, and Wojtkiewicz in developing probabilistic conditions for provable convergence of the trust-region algorithm. The first set of results show that these probabilistic conditions are in terms of the approximation errors of the response surface [2].

The focus of this presentation is on investigating the relationship between spatial correlation that is inferred from the analysis of the response surface and the conditions for provable convergence of the trust-region algorithm. Comparisons are made between:

- ordinal optimization [3] without models for correlation;
- ordinal optimization with linear models for correlation;
- models based on spatial statistics.

While the more complex models require stronger assumptions on the function being optimized, they are also considerably more efficient. The use of spatial statistical models become particularly efficient in the critical phase where the trust-region algorithm approaches convergence and the trust-region size decreases.

References

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[2] T. Igusa, "Role of Error Quantification in Provably Convergent Optimization under Uncertainty," Lecture presented at the Sandia National Laboratories, Albuquerque, NM, August 12, 2002.

[3] H.C. Chen, C.H. Chen, and E. Yucesan, "Computing Efforts Allocation for Ordinal Optimization and Discrete Event Simulation," *IEEE Transactions on Automatic Control*, v. 45, p. 960-964, 2000.